APPLICATION FOR

U.S. LETTERS PATENT

FOR

"SPLIT ICE MAKING AND DELIVERY SYSTEM FOR MARITIME AND OTHER APPLICATIONS"

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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to ice makers for marine vessels and recreational vehicles (RV) and other applications, and, more particularly, to a split marine ice making and delivery system which locates the ice making sub-assembly adjacent or in close proximity to the ice storage bin and away from the condenser unit or compressor unit.

2. General Background

Presently, refrigerant systems for marine applications are made of a single unit which pushes ice threw long tubes which frequently clog such as, when pieces of ice adhere together. Moreover, such refrigerant systems are relatively noisy as the ice is pushed to remote locations 20, 30, and 40 of feet away.

For example, U.S. Patent No. 4,922,724, issued to Grayson, et al., entitled "MARINE ICE MAKING AND DELIVERY SYSTEM" discloses a refrigeration circuit located on the engine deck of a marine craft having an ice making assembly and a flexible conduit coupled to the output of the ice making assembly. The flexible conduit has a

length sufficient to reach upper levels of the marine craft and reaches horizontally remote locations from the refrigeration circuit to deliver ice.

U.S. Patent Nos. 4,576,016 and 4,574,593, issued to Nelson, entitled "ICE MAKING APPARATUS" discloses a combination evaporator and auger-type ice-forming assembly operatively disposed between an ice product receiving area and a drive means assembly.

U.S. Patent Nos. 4,433,559, issued to King-Seeley Thermos Co., entitled "ICE MAKING APPARATUS" discloses an ice-making apparatus having a rotatable auger and a helical evaporator. The output of the ice-making apparatus is delivered to an extruder mechanism which causes flaked ice from the ice-making apparatus to be compacted or compresses and formed into discrete ice bodies or cubes. The ice bodies or cubes are delivered to a storage bin via a conduit.

As can be appreciated there is a continuing need for a split ice making and delivery system which eliminates forcing through very long conduits ice product which oftentimes becomes clogged.

As will be seen more fully below, the present invention is substantially different in structure, methodology and approach from that of the prior

refrigeration systems.

SUMMARY OF THE PRESENT INVENTION

The preferred embodiment of split ice making and delivery system of the present invention solves the aforementioned problems in a straight forward and simple manner.

Broadly, the present invention contemplates a split ice making and delivery system comprising: a condenser and compressor sub-assembly which compresses and condenses refrigerant; a remote ice making sub-assembly having a rotating auger, a fresh water freeze chamber adapted to be filled with portable fresh water and an outlet wherein rotation of said auger forces out, of said outlet, ice product; and, a refrigerant delivery sub-assembly coupled to said condenser and compressor sub-assembly and said remote ice making sub-assembly for delivering therebetween said refrigerant wherein said refrigerant delivery sub-assembly has a length sufficient to reach a remote room or remote location and to reach said remote ice making sub-assembly remote from said condenser and compressor sub-assembly.

In view of the above, an object of the present invention is to provide a split ice making and delivery system comprising an ice storage bin which is located in

close proximity to the remote ice making sub-assembly; and, means for channeling ice product from the remote ice making sub-assembly to the ice storage bin wherein the ice channeling means has a length less than 10 feet.

Another object of the present invention is to provide a split ice making and delivery system having a remote ice making sub-assembly which is capable of producing 380-500 pounds of ice per day.

A further object of the present invention is to provide a split ice making and delivery system having a combination remote ice making sub-assembly and ice storage bin wherein the remote ice making sub-assembly includes a compact housing for storing the remote ice making sub-assembly wherein the housing has a height of approximately 29 ½ inches and a width and depth of 12 inches.

A still further object of the present invention is to provide a split ice making and delivery system having a remote ice making assembly which includes an evaporator coiled around an auger having a refrigerant inlet line receiving refrigerant from via a refrigerant delivery line of the refrigerant delivery sub-assembly from the condenser and compressor sub-assembly to the refrigerant inlet line and a refrigerant outlet line expels spent refrigerant on return refrigerant delivery line to the

condenser and compressor sub-assembly.

A still further object of the present invention is to provide a split ice making and delivery system having a control temperature sensor integrated into or affixed to an ice storage bin wherein as the ice product reaches a predetermined level, a decrease in temperature is realized at the control temperature sensor and the condenser and compressor sub-assembly and the remote ice making sub-assembly are deactivated.

A still further object of the present invention is to provide a split ice making and delivery system having a thermo-expansion valve in-line between the remote ice making sub-assembly and the condenser and compressor sub-assembly.

In view of the above, a feature of the present invention is to provide a split ice making and delivery system which eliminates long conduits through which ice is channeled to a remote ice storage bin.

Another feature of the present invention is to provide a split ice making and delivery system which minimizes the operating noise.

A further feature of the present invention is to provide a split ice making and delivery system which channels through long conduits refrigerant to remote location in a marine vessel or craft or RV.

A still further feature of the present invention is to provide a split ice making and delivery system which includes a water cooled condenser unit for marine applications wherein raw water from about the marine vessel is used or an air cooled condenser unit is used for RV applications.

The above and other objects and features of the present invention will become apparent from the drawings, the description given herein, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWING

For a further understanding of the nature and objects of the present invention, reference should be had to the following description taken in conjunction with the accompanying drawings in which like parts are given like reference numerals and, wherein:

FIGURE 1 illustrates a view of the split ice making and delivery system of the present invention deployed on a marine vessel;

FIGURE 2 illustrates a general schematic diagram of the refrigeration circuit of the split ice making and delivery system of the present invention;

FIGURE 3 illustrates a perspective view of the remote ice making sub-assembly in combination with an ice bin of the present invention;

FIGURE 4 illustrates a cross sectional view along the **PLANE 4 - 4** of **FIGURE 5**;

FIGURE 5 illustrates a perspective the internal components of the remote ice making sub-assembly; and,

FIGURE 6 illustrates a cross-sectional view along the **PLANE 6-6** of **FIGURE 3**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and in particular **FIGURES 2 - 5**, the split ice making and delivery system of the present invention is generally referenced by the numeral **10**. The split marine ice making and delivery system **10** is generally comprised of a compressor and condenser sub-assembly **20** in fluid communication with a remote ice making sub-assembly **50** via a refrigerant delivery sub-assembly **40**. The split marine ice making and delivery system **10** may further include an ice storage bin **70** or it may stand alone. The ice storage bin **70** includes a ice scoop or ladle **71**.

Referring now to **FIGURE 1**, the split marine ice making and delivery system **10** is adapted for marine applications wherein the refrigeration circuit **100** of the split ice making and delivery system **10** is split into two general sub-assemblies, the compressor and condenser sub-assembly **20** and the remote ice making sub-assembly **50** adapted to be separated by many feet, compartments or floors of a marine vessel **1** via a refrigerant delivery sub-assembly **40**. In an alternate embodiment, the split

marine ice making and delivery system **10** is adapted for RV applications.

In the marine application, the compressor and condenser sub-assembly **20** is adapted to be deployed in the engine room **2** where raw water or sea water is easily accessible while the remote ice making sub-assembly **50** is adapted to be located in another compartment or floor **3** remote from the engine room **2**. Since, the remote ice making sub-assembly **50** is in fluid communication with the compressor and condenser sub-assembly **20** via the refrigerant delivery sub-assembly **40**, the ice **90** does not have to be communicated remotely to the ice storage bin **70** on the marine vessel. Instead, the refrigerant fluid having a natural tendency to flow is easily communicated remotely in the refrigerant delivery sub-assembly **40** between the compressor and condenser sub-assembly **20** and the remote ice making sub-assembly **50**. Hence, clogging ice in such long conduits is eliminated.

Additionally, locating the compressor and condenser sub-assembly **20** in the engine room **2** or other location minimizes the impact of the operational noise therefrom on the occupants of the marine vessel **1**.

Referring now to **FIGURES 3 - 6**, the remote ice making sub-assembly **50** is housed in housing unit **52**. The remote ice making sub-assembly **50** and housing unit **52** are compact and are designed to be located in close proximity to the ice storage bin **70**. In the exemplary embodiment, the housing unit **52** has affixed thereto the ice storage bin **70**. As best seen in **FIGURE 6**, the housing unit **52** has mounted to a front surface thereof a first coupler or rail **73**. The ice storage bin **70** comprises a second coupler or channel guide **74** adapted to connect to or mate with the first coupler or rail **73** to secure the ice storage bin **70** to the housing unit **52**. The housing unit **52** further includes means for channeling ice **75** which is coupled to the chamber outlet **53b**. The means for channeling ice **75** includes any one of a hose or tubing having a length of a few inches up to 10 feet or a chute. The hose or tubing of the means for channeling ice **75** has a diameter of approximately 1 inch. Furthermore, the front of the housing unit **52** is provided with a manual reset button **78** to allow occupants to manually reset the system **10**.

In the preferred embodiment, the housing unit includes lid **76** and rear brackets **77** for affixing the housing unit **52** to a wall.

The remote ice making sub-assembly **50** includes a rotatable auger **54** rotatably mounted in a freeze chamber **66** and which is rotated by a high torque motor **56** connected via gear box **58** to the rotatable auger **54**. Thereby, no other extruding mechanism is needed to force the ice through long conduits. The gear box **58** is stacked above the high torque motor **56**. The freeze chamber **66** and auger **54** are stacked above the gear box **58**.

The remote ice making sub-assembly **50** further includes an evaporator **60** which is coiled around the auger **54** and an insulating housing **64** encapsulating the evaporator **60**. Refrigerant is supplied via the refrigerant delivery line **42a** of the refrigerant delivery sub-assembly **40** from the compressor and condenser sub-assembly **20** to the refrigerant inlet line **61a** of the evaporator **60**. The refrigerant outlet line **61b** of the evaporator **60** expels the spent refrigerant on return

refrigerant delivery line **42b**. The return refrigerant delivery line **42b** delivers the spent refrigerant to the compressor and condenser sub-assembly **20**.

The auger **54** is selectively rotated by motor **56** to scrap or shave the frozen water in the freeze chamber **66** and create ice **90**. The fresh water from the fresh water reservoir **80**, which includes a float **83**, fills the freeze chamber **66**.

Referring again to **FIGURE 2**, the refrigeration circuit **100** will be described in more detail. The compressor and condenser sub-assembly **20** includes a compressor unit **22** which supplies a flowable gaseous refrigerant, such as refrigerant R-22, to the condenser unit **24** on the condenser refrigerant inlet line **25a**. The condenser unit **24** cools or liquefies the gaseous refrigerant and outputs, on the condenser's outlet line **25b**, the liquified refrigerant to the refrigerant inlet line **61a** of the evaporator **60** via the refrigerant delivery line **42a**. A TXV or thermo-expansion valve **45** for metering the refrigerant is coupled in-line between the refrigerant delivery line **42a** and the refrigerant

inlet line **61a** of the evaporator **60**.

The liquified refrigerant flows through the evaporator **60** and exits the evaporator at the refrigerant outlet line **61b** and flows back to the compressor unit **22** where the refrigerant loop begins. As the liquified refrigerant flows through the evaporator **60**, the water in the freeze chamber **66** freezes via heat transfer.

The evaporator **60** surrounding the exterior of the freeze chamber **66** causes the fresh water therein to freeze as the refrigerant flows therethrough. As the auger **54** rotates the frozen fresh water is shaved to create ice **90**. Moreover, as the auger **54** rotates, the shaved ice **90** is channeled upward to chamber outlet **53b** where ice **90** is expelled and stored in ice storage bin **70**.

In the exemplary embodiment, the condenser unit **24** includes a water cooled, cooper-plated tubing having a raw water inlet line **26a** and a raw water outlet line **26b**. The raw water inlet line **26a** receives raw water from the engine room or from outside the marine vessel **1**. There is a conventional water controller valve **29** in inlet line

26a for controlling water in-take flow. As the raw water flows through the condenser unit **24**, the spent raw water exits therefrom through the raw water outlet line **26b**. The flow of the raw water through the condenser unit **24** is controlled via pumping unit **30**.

The raw water inlet line **26a** is an outer annular tubing and has concentric therethrough the condenser's refrigerant line (not shown) terminating between the condenser refrigerant inlet line **25a** and the condenser refrigerant outlet line **25b**. The raw water intake is controlled by the water controller **29** in line **26a** which is controlled by the pressure of the system **10** for maximum efficiency of the system **10**.

The water controller **29** is used in the system **10** to accommodate for a range of raw water temperatures such as from 40 degrees to 95 degrees Fahrenheit. The condensing unit **24** also has low and high pressure control.

The refrigeration circuit **100** further includes a control temperature sensor **85** integrated into or affixed to the ice storage bin **70**. Thereby, as the ice level increases in the ice storage bin **70**, the ice **90** will

reach the sensor's level. The control temperature sensor **84** is temperature sensitive to the temperature of ice and coupled to thermostat **87**. The control temperature sensor **85** deactivates the motor **56**, the pump **30** and compressor unit **22** thereby deactivating the refrigeration circuit **100**. In other words, the compressor and condenser sub-assembly **20** and the remote ice making sub-assembly **50** are deactivated.

Moreover, a water switch **82** is provided to maintain water pressure at a minimum of 10 psi. If the fresh water reaches below 10 psi, the system **10** will deactivate until the pressure reaches 10 psi. The system can be deactivated by providing a conventional safety switch or thermostat in bin **70**.

In the exemplary embodiment, the voltage (V) is 230 V or 115 V single phase and is delivered on lines **1a**, **1b**, and **1c**. Lines **2a**, **2b** and **2c** are coupled to ground or common. In operation, when the temperature decreases as the result of a high ice level, the thermostat **87** switches off the voltage (V) delivered on lines **1a, 1b** and **1c**.

Extremely low temperatures are used to achieve a

super low temperature in which the auger **54** rotated under the high torque motor **56** can shave the ice and produce super amount of ice in a small amount of time and with little water. This is achieved by the TXV **45** in conjunction with a condensing unit **24**. For example, the system **10** can produce 380-500 pounds of ice per day.

The remote ice making sub-assembly **50** is designed to be compact so that it can be accommodated in a variety of locations where available space is constrained. In the exemplary embodiment, the remote ice making sub-assembly **50** has a height of approximately 29 ½ inches and a width and a depth of 10 inches. As can be appreciated, the remote ice making sub-assembly **50** can be stored under a cabinet, in a closet or on top of a counter. The housing unit **52** is made of aluminum, high temperature primer and baked on paint to protect the remote ice making sub-assembly **50** from salt water.

In the RV environment, in lieu of a water cooled condenser unit, an air cooled condenser is used. For example, a fan is substituted to cool the refrigerant with air.

Because many varying and differing embodiments may be made within the scope of the inventive concept herein

taught and because many modifications may be made in the embodiment herein detailed in accordance with the descriptive requirement of the law, it is to be understood that the details herein are to be interpreted as illustrative and not in a limiting sense.

What is claimed as invention is: